

Public Comments on Interim Staff Guidance DC/COL-ISG-20 and Staff Resolution

NEI Comments:		
Comments	Proposed Resolution	NRC Staff Resolution
<p>1. Section 5.1.1 states that screening of rugged SSCs can be performed on the basis of the DC's CSDRS with its PGA scaled by a factor of 1.67. Section 5.2.2 should include a similar statement that screening of site-specific and plant-specific information for the COL site can be performed based on the COL's GMRS with its PGA scaled by a factor of 1.67.</p>	<p>Add the following sentence to Section 5.2.2:</p> <p>“Screening of rugged site-specific and plant-specific information for the COL site can be performed based on the COL's GMRS with the PGA scaled by a factor of 1.67.”</p>	<p>Since the screening is used to assist the plant system and accident sequence analysis, Section 5.2.1 is appropriate for the proposed addition.</p> <p>The following sentence will be added to the end of the 1st Paragraph of Section 5.2.1:</p> <p>“To assist the update, the screening process similar to Section 5.1.1 can be employed and the screening of rugged site-specific and plant-specific information for the COL site can be performed based on the COL's GMRS with the PGA scaled by a factor of 1.67, following the guideline provided in HLR-SHA-G1 of Section 5-2.1 of Part 5 of the ASME/ANS PRA standard.”</p>
<p>2. In Section 5.1.2, 3rd Paragraph, instead of specifying a TRS at a 99 percent confidence level, the guidance should be to show less than a 1% probability of failure at a ground motion equal to 1.67 times the CSDRS. Testing uncertainties should be considered.</p>	<p>Replace the 2nd and 3rd Sentences with the following:</p> <p>“For equipment on the SEL, which is to be qualified by seismic qualification tests, the procedure described in E.5 of the Electric Power Research Institute (EPRI) Report 1002988, “Seismic Fragility Application Guide,” issued December 2002 (Ref. 13), is acceptable for developing fragilities. When using the Ref. 13 procedure, there should be less than a 1% probability of failure at a ground motion equal to 1.67 times the CSDRS, including consideration of testing uncertainties.”</p>	<p>The staff agrees with the proposed changes, which will be incorporated in the ISG.</p>

<p>3. In Section 5.2.1, the following phrase is confusing as written: “...(1) site-specific soil effects are deemed not controlling with adequate justification the seismic fragility of the pertinent SSC and the plant-level HCLPF...”</p>	<p>Replace the identified phrase with the following: “...(1) site-specific soil effects on the seismic fragility of the pertinent SSC and the plant-level HCLPF are deemed not controlling with adequate justification...”</p>	<p>The staff agrees with the proposed changes, which will be incorporated in the ISG.</p>
<p>4. In Section 5.2.2, 2nd Paragraph, 1st Sentence, editorial change to correct subject-verb agreement.</p>	<p>Change “are” to “is” as follows: “...updating of the seismic fragility of these SSCs is necessary...”</p>	<p>The staff agrees with the proposed change, which will be incorporated in the ISG.</p>
<p>5. In Section 5.2.2, 2nd Sentence, 3rd Paragraph, the settlements specified in the DCD are guidelines for acceptable settlements associated mainly with construction and are monitored during and after construction. A COL may have higher estimated settlements than specified in the DCD; in such cases, the COL applicant provides justification that the estimated settlements can be appropriately addressed during construction and the final installation and fit-up of equipment, piping, conduits, etc., especially between structures, can and will be done to ensure their safety function. The impact of settlements associated with seismic fragility analysis for liquefaction on the plant sequence level HCLPF should be based on the expected site configuration of the safety related SSC including site layout and design for umbilicals between structures, etc. The allowable settlements specified in the design control documents for the reference DC are not necessarily the appropriate limit state for COL site-specific conditions for soil liquefaction fragility evaluations.</p>	<p>Replace the 2nd Sentence with the following:</p> <p>“Fragility for seismic induced liquefaction can be developed using a fragility method described in Section G of the EPRI report “Seismic Fragility Application Guide” (Ref. 13), together with the appropriate limit state defined in terms of the consequences of settlement on the site configuration of safety related SSC, including site layout, umbilicals between structures, and buried pipes and concrete electrical ducts.”</p>	<p>The allowable settlements specified in the DCD are site parameters postulated for standard designs. The limit state defined based on these allowable settlements is conservative. The staff recognizes that the site-specific conditions may result in higher estimated settlements than specified in the DCD, which are nonetheless found acceptable for ensuring the safety functions of the affected SSC with adequate justifications.</p> <p>The following sentence is added to the end of 3rd Paragraph, Section 5.2.2:</p> <p>“Alternatively, the limit state may be defined in terms of the consequences of settlement on the site configuration of safety related SSC, including site layout, umbilicals between structures, and buried pipes and concrete electrical ducts when adequate justifications are provided.”</p>
<p>6. In Section 5.2.3, 2nd Paragraph, it may be possible to address a HCLPF capacity of less than 1.67 times the site-specific GMRS by</p>	<p>Reword as follows: “...(2) the COL applicant performs full convolution of sequence fragility for necessary</p>	<p>The staff does not agree with the proposed change. The term “all sequences” will be replaced with “all</p>

<p>performing a full convolution of a subset of the sequences rather than of all the sequences.</p>	<p>sequences with the mean hazard curve to develop risk metrics to demonstrate that the seismic risk is acceptably low for the licensed plant.”</p>	<p>sequences (Note: the number of sequences adequate for quantifying core damage frequency can be determined using the guideline provided in HLR-SPR-E1 of Section 5-2.3 of Part 5 of the ASME/ANS PRA standard) with a potential to lead to core damage.”</p>
<p>7. In Section 5.3, 2nd Paragraph, the quotation marks in the last sentence appear to be unnecessary.</p>	<p>Delete the quotation marks from the last sentence.</p>	<p>The staff agrees with the proposed change, which will be incorporated in the ISG.</p>
<p>M.K. Ravindra Comments:</p>		
<p>1. For systems analysis and fragility analysis, the guidance is to follow the supporting requirements of ASME/ANS RA-Sa-2009 Part 5 Capability Category I. Most of the supporting requirements in this standard are the same for Capability Categories I and II (except SFR-A2, SFR-F3, SPR -B6, SPR -B9, SPR-E2 and SPR-E5). Since the industry is targeting to meet Capability Category II requirements for existing nuclear power plants, the basis for accepting a lower category for new reactors should be substantiated. Alternatively, the Capability Category II requirements are to be met with a few exceptions noted because plant-specific data is not available at the DC/COL stage.</p>	<p>None.</p>	<p>The selection of Capability Category I to support PRA-based seismic margin analyses is consistent with the staff position provided in DC/COL-ISG-03, “Probabilistic Risk Assessment Information to Support Design Certification and Combined License Applications,” dated June 11, 2008, concerning the review of probabilistic risk assessment (PRA) information and severe accident assessments submitted to support design certification (DC) and combined license (COL) applications. Capability Category II or higher may be used to support risk-informed activities.</p>
<p>2. The "min-max" method for calculating the sequence level HCLPF is permitted (page 6).</p> <p>The definition of the terminology is not clear. Does the method pertain to combining the fragilities of components in OR or AND gates or to estimating the HCLPF capacities?</p>	<p>None.</p>	<p>The min-max method was generically defined in Section 2.0 of the ISG. Section 5.1.3 stated clearly that this method is acceptable for computing sequence-level HCLPF values. The min-max method should not be used</p>

<p>The latter approach. (see NUREG/CR-4482 by Prassinos, Ravindra and Savy, 1986) has been used in a number of DC applications and it is a deterministic way of calculating the sequence level HCLPF capacity. However, the method cannot satisfactorily handle random failures and operator actions which are to be considered in a PRA based SMA per ISG-20. More specific guidance on this topic is needed.</p>		<p>to determine the sequence level fragility for the reasons provided in the comment. Since estimating sequence-level HCLPF values are a primary goal for PRA-based seismic margin analysis, sequence-level fragility is not needed unless risk metrics are required. In that case, appropriate Boolean algebra should apply such that random failures and operator actions can be appropriately accounted for.</p>
<p>3. In Sec. 5.1.4, 2nd Paragraph, it is stated that "(3) demonstrate that the design-specific plant-level HCLPF capacity is maintained at the COL stage." Is this capacity anchored to CSDRS or GMRS?</p>	<p>None.</p>	<p>As stated in Section 5.1.3, the HCLPF value should be expressed in terms of PGA for consistency in the PRA-base seismic margin analysis process. The same section further stated that the design-specific plant-level HCLPF value should be demonstrated to be equal to or greater than 1.67 times the CSDRS PGA. Therefore, the plant-level HCLPF should be demonstrated consistently from DC to COL, but the HCLPF anchorage will depend on the situations. In a DC, the HCLPF should be anchored to CSDRS, while in a COL, the HCLPF should be anchored to GMRS if the seismic fragility is controlled by site-specific soil failures or SSC that are not part of the standard design. The detailed discussion on the anchorage issue for COLAs is provided in Section 5.2.2, 3rd Paragraph.</p>

<p>4. In page 3 it is required that the scope include all plant operating modes (i.e., full power, low power and shutdown). Have the DCs issued or an application done this?</p>	<p>None.</p>	<p>YES. (e.g., ESBWR DCD tier 2, Chapter 19)</p>
<p>5. Sec. 5.1.2 states "In this procedure, consistent with Ref. 13 of the above EPRI guidance document, the TRS should be specified at the 99 percent confidence level to account for uncertainties in tests". This requirement is not specifically mentioned in the referenced document. It requires a probabilistic seismic response analysis of the structures to derive the 99 percent confidence floor spectra. Is it feasible at the DC stage?</p>	<p>None.</p>	<p>This issued has been addressed in the response to the NEI comment No. 2.</p>
<p>Editorial:</p> <p>1. On Page 2 "Min-Max" method is defined; on Page 6, use of "max-min" method is permitted</p> <p>2. Sec. 5.2.2 Second Paragraph, 2nd Sentence "In addition..." is not clear.</p> <p>3. Is the EPRI Seismic Fragility Application Guide (EPRI 1002988) generally available to the public or is it restricted to EPRI members?</p>	<p>None.</p>	<p>1. Change will be made from max-min to Min-Max.</p> <p>2. The 1st Sentence of Sec. 5.2.2, 2nd Paragraph deals with the DC SSC which may be susceptible to the site-specific soil-failures, while the 2nd Sentence after "In addition, pertains to the COL SSC (Not part of the standard design) which may need to be added to new or existing sequences.</p> <p>3. It is available to the public.</p>

James Johnson Comments:	
<p>1. Calculate plant HCLPF for Design Certification:</p> <p>a. Sec. 5.1.2 Seismic Fragility Evaluation, Paragraph 2: "Second, the seismic fragility calculation should use the response spectrum shape defined as the DC's CSDRS." The control point location is not specified in this statement. Hence, if the vendor assumes the CSDRS is at foundation level of the Seismic Category I structures in the free-field, e.g., for simplification of analysis, added conservatism, etc., is the acceptance criterion of a plant HCLPF of 1.67 times the CSDRS PGA (see item 2 below) referred to the foundation level motion or is it permissible to remove potential conservatism due to the control point location and refer the plant HCLPF to motions at the free-field ground surface?</p> <p>b. Section 5.1.3 Plant-Level Capacity of HCLPF, last sentence of Paragraph 1: "The design-specific plant-level HCLPF value should be demonstrated to be equal to or greater than 1.67 times the CSDRS PGA." What is the response spectrum shape and at what location is it applied? Can potential conservatisms in the location be removed, e.g., by moving the location from the foundation-level to the soil free surface?</p>	<p>a. Some DC vendors applied CSDRS at foundation level of the Seismic Category I structures in the free-field, which is conservative as a design practice. For seismic margin assessments, which provide a quantification of the conservatism in the seismic design, the control point for the CSDRS should be placed at the free-field ground surface, and the plant HCLPF should be determined with respect to the CSDRS PGA at the free-field ground surface.</p> <p>b. The respective paragraph stated that HCLPF is associated with CSDRS PGA. Further, Section 5.1.2 states that the seismic fragility calculation should use the response spectrum shape defined as the DC's CSDRS. Any design conservatism should be credited for the fragility calculations with restrictions provided in the ISG.</p>
<p>2. Updating the DC PRA-Based Seismic Margin Analysis by COL Applicants: In general, this step includes updating the plant system and accident sequence analysis, the seismic fragility evaluation, and the plant-level capacity of high confidence of low probability of failure.</p> <p>a. The systems models are updated to include site-specific and plant-specific features.</p> <p>b. The seismic fragility evaluation is updated to account for site-specific effects and plant-specific features. Section 5.2.2, Paragraph 3, Sentence 1: "When the seismic fragility analysis is performed considering the site-specific effects and plant-specific features, the response spectrum shape should be based on the COL site-specific GMRS." In the accident sequences of a., some items on the SEL have HCLPF values based on the CSDRS and others based on the GMRS for the site.</p>	<p>a. This is consistent with the description in the ISG comment so no change is needed.</p> <p>b. Based on the guidance provided in Section 5.2.2, COLA should not update the DC SSC if these are not affected by the site-specific soil failures. For those DC SSCs susceptible to the site-specific soil failures, their fragilities should be estimated based on the GMRS for the site.</p> <p>c. See response to M.K. Ravindra Comment No. 3.</p>

<p>c. The plant-level HCLPF is updated. Section 5.2.3, Paragraph 1, last sentence: "The plant-specific plant-level HCLPF value should be demonstrated to be equal to or greater than 1.67 times the site-specific GMRS PGA." Same question as item 1b above.</p>	
<p>3. Verification of plant-level HCLPF after issuance of COL</p> <p>a. Section 5.3:</p> <p>Paragraph 1: "The COL holders verify the plant SSC capacity to demonstrate that the plant and sequence-level HCLPF capacity is consistent with the FSAR. COL holders perform the verification based on the as-designed, as-built configuration of the plant. The plant walkdown process described in EPRI NP-6041 (Ref. 12) can be used for the capacity verifications."</p> <p>Paragraph 2, end of sentence 1: "...confirm that the as-designed and as-built plant-level HCLPF capacity is at the level of 1.67 times the site GMRS PGA, or the values reviewed and approved for the licensee."</p> <p>b. Section 5.2.3, as discussed in Item 2c above, and item 3a above imply that the acceptance criterion is a plant-level HCLPF equal to or greater than 1.67 times the site-specific GMRS PGA? Is the seismic demand for the plant walkdown in terms of the site specific GMRS? Specifically, are non-Seismic Category I or II SSCs evaluated for their affect on Seismic Category I SSCs given the seismic demand for the GMRS? Is the evaluation of field routed commodities performed based on the seismic demand of the GMRS?</p>	<p>a. The staff does not understand the questions.</p> <p>b. Yes. If the HCLPF target cannot be met, Section 5.3.2 provides two options that are acceptable to the staff. The purpose of the plant walkdown is to verify the DC and COL commitments are adequately reflected in the as-design and as-constructed plant. To this end, for those DC SSCs, which are not affected by the site-specific features, the verification will be carried out using CSDRS. Similarly, for COL SSC, the verification will be based on GMRS. II/I seismic interaction issues should be adequately addressed in the respective DC or COL SSC by using the associated spectrum shape.</p>
<p>4. If the plant-level HCLPF is governed by the site-specific effects and/or plant-specific features, does the Licensee have the obligation to maintain the criteria of demonstrating HCLPF values for DC SSCs to be 1.67 times the CSDRS PGA throughout the operating life of the plant?</p>	<p>This ISG applies only to DCs and COLs. When a plant is in operation, 10 CFR 50.71 (h) requirements will apply. DC/COL-ISG-03 provides guidance on this topic, which is not within the scope of this ISG.</p>